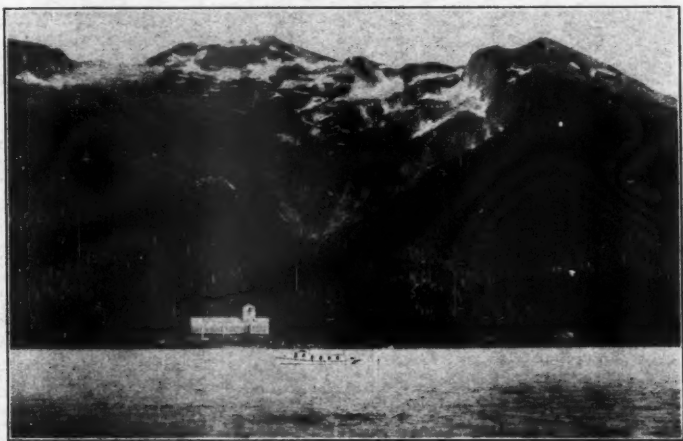


# ROCKS and MINERALS

Vol. 3

MARCH, 1928

No. 1



*Copper Mountain (Snow-clad), Sulzer, Alaska*

## SPECIAL ARTICLES

THE GEOLOGY OF THE ISLAND OF GUAM

*By Lieut.-Commander P. J. Searles*

THE ROMANTIC HISTORY OF MONAZITE

*By Edward Cahen*

THE RADIO-ACTIVE MINERALS OF AUSTRALIA

*By M. Mawby*

THE MAGAZINE FOR COLLECTORS

# THE BULLETIN BOARD

## THE ROCKS AND MINERALS ASSOCIATION

### Its Organization and an Introduction of Its Officers to the Members

We would like to announce that in the early part of the year, a few of the enthusiastic and deeply interested subscribers to **ROCKS AND MINERALS**, met and discussed the Rocks and Minerals Association and ended by electing Morrell G. Biernbaum, Honorary President; Charles W. Hoadley, Dr. W. F. Foshag, Dr. Bertha Chapman Cady, Dr. Henry C. Dake, Mrs. Ilseil Nathalie Gaylord, O. Ivan Lee, Benjamin T. Diamond, Gilbert Hart, Edward Cahen, and M. Mawby, Honorary Vice-Presidents; and Peter Zodac, Secretary-Treasurer.

This meeting had been supplemented by correspondence with other subscribers who had expressed their sympathy in the movement. All of these officers are not only well known but have a high standing and considerable influence in their professional life and among those interested in mineralogy and nature study.

We feel that no better selection could have been made. The officers represent different and quite widely separated districts and we believe that their selection and their acceptance of the offices means a great deal to the success of the Rocks and Minerals Association.

We take pleasure in presenting them to the members of the Association. Although some of them are so well known that we have felt the briefest of introductions was all that was necessary so far as they were concerned.

Morrell G. Biernbaum, who is known to many of our readers through some very enjoyable articles which have heretofore appeared in the magazine, is the first Honorary President of the Association. We feel we could not have made a better selection. For Mr. Biernbaum is not only a valuable contributor to **ROCKS AND MINERALS** but is also keenly interested in furthering the fascinating study of minerals among people in general but the younger generation in particular.

Charles W. Hoadley is another of our esteemed friends who is much interested in the success of the magazine and in the growth of the Association. In this issue of **ROCKS AND MINERALS** he again contributes an article, an article on garnets which contains information that should be appreciated by those who are giving special attention to this mineral. Mr. Hoadley is an Honorary Vice-President of the Association.

Dr. W. F. Foshag is Assistant Curator of the U. S. National Museum at Washington, D. C. His very encouraging letters to the Editor of **ROCKS AND MINERALS** have been most helpful and his suggestions regarding this purposes of the Rocks and Minerals Association have been of great assistance in outlining those activities in which we desire to engage individually as members of the Association. Dr. Foshag is an Honorary Vice-President of the Association.

Dr. Bertha Chapman Cady is the Girl Scout Naturalist attached to the Girl Scout National Headquarters in New York City. She is keenly interested in Nature Study, particularly among girls, and we have had some very encouraging letters from her in regard to the magazine and the Rocks and Minerals Association in whose purposes she is in sympathy. Dr. Cady is an Honorary Vice-President of the Association.

Dr. Henry C. Dake is an enthusiastic mineralogist of Portland, Oreg., who has been a contributor to **ROCKS AND MINERALS**. He has an excellent little article in this issue on a unique mineral locality in Oregon. Dr. Dake is an Honorary Vice-President of the Association.

Mrs. Ilseil Nathalie Gaylord needs no introduction to the readers of **ROCKS AND MINERALS** or to the members of the Association. Her "Beginner's Cabinet" has been a feature of the magazine from its first issue. Mrs. Gaylord is an Honorary Vice-President of the Association.

O. Ivan Lee is a regular contributor to **ROCKS AND MINERALS** and has been introduced to our readers before. His "Notes and News of Minerals of the Rarer Elements" is a feature that is keenly appreciated by those of us who specialize in these interesting, and too often unattractive, minerals. Mr. Lee is an Honorary Vice-President.

Benjamin T. Diamond is another of our regular contributors to **ROCKS AND MINERALS** who needs no introduction and his "Paleontology Department" is proving very popular with many collectors who have made fossils their study. Mr. Diamond is an Honorary Vice-President.

Gilbert Hart is also one of our regular contributors whom the readers are already acquainted with and in this issue he has contributed three series of excellent articles. Mr. Hart is an Honorary Vice-President of the Association.

Edward Cahen of Dunsford, Exeter, England, is another of our firm friends and contributors who has been introduced to the readers in an earlier issue. He has a most interesting article on Monazite in this number of the magazine. Mr. Cahen is an Honorary Vice-President of the Association.

M. Mawby of Broken Hill, Australia, has also been introduced to the readers of **ROCKS AND MINERALS**. We might add that he lives in a district whence have come some most interesting mineral specimens and in this issue of the magazine has an article on radio-active minerals found in Australia. Mr. Mawby is an Honorary Vice-President.

We are sure that these officers who have been selected by members of the Association will be gladly welcomed by the other Association members and will receive the united congratulations, best wishes, and full support of the Association.

**WANTED:** Correspondents in all parts of the world who will be kind enough to send us notes and news items on minerals, etc., that they

think may be interesting to the subscribers of "Rocks and Minerals." Such as are available we shall be very glad to print in the magazine.





# ROCKS AND MINERALS

## *The Magazine for Collectors*

Published  
Quarterly

Peter Zodac  
Editor and Publisher

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*The Official Journal of The Rocks and Minerals Association*

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Vol. 3

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**ROCKS AND MINERALS**

**PEEKSKILL, N. Y., U. S. A.**

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## THE NATURE LORE SCHOOL

will hold its 9th Annual Session at

### CAMP ANDREE

Briarcliff Manor, New York

June 16-30, 1928

It will be directed by the

### COORDINATING COUNCIL ON NATURE ACTIVITIES

The purpose of this School is to further the interests of nature studies and activities by training leaders for nature service.

The daily program provides for half days to be devoted to group and individual study. These are to be selected from the following list of activities:

FORESTRY

PLANT ECOLOGY

GEOLOGY

ARTS AND CRAFTS

INDIAN LORE

INSECTS

There will be *early morning bird walks* each day. The afternoons will be devoted to *field trips*. Campfires will be given over to dramatics, music, special talks and story telling. *Star study* will be a feature each evening after campfire.

For further information address: Dr. Bertha Chapman Cady, Ex. Sec'y Coordinating Council, American Museum of Natural History, 77th and Central Park West, New York, N. Y.

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Dr. Cady is one of the Vice-Presidents of the Rocks and Minerals Association.

—Editor.

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## THE GEOLOGY OF THE ISLAND OF GUAM

By P. J. SEARLES

Lieutenant-Commander, U. S. Navy

Navy Yard

Boston, Mass.

In the first place where is and what is Guam? Guam is the southernmost of the Mariana Islands, a chain extending in a general north and south direction between Latitudes  $12^{\circ}$  and  $18^{\circ}$  N., and in Longitude  $142^{\circ}$  E. It is approximately 5,500 miles from San Francisco, 3,500 from Honolulu, and 1,600 to 2,000 miles from Manila, China, and Japan. It is inhabited by 17,000 Chamorros, a race with distinct Polynesian affinities, and by a transient American Navy and Marine Corps garrison. The island is tropical in every respect and still retains many of the romantic aspects of the South Seas.

The Mariana Islands form part of what is known as the Sunda Arc, an almost continuous ring of volcanic activity, whose geometrically exact center is a little west of Mayon volcano in Luzon, and whose circumference is marked by volcanoes such as Fujiyama in Japan, the active cones of Java and Sumatra, and many hot springs, solfataras and the like in China. The Marianas, then, strung like beads along an arc of a great volcanic ring, which resembles in so many ways the huge mountain rings of the moon, are really the tops of a submerged mountain chain, raised from the sea bottom by forces which have died out in the southern but are still alive in the northern islands. The coral limestone plateaus and reefs testify to a long succession of upheavals and subsidences, some of which were geologically very recent.

Guam is of volcanic origin and is fringed with coral reefs—this in general describes its geology, though some of the details are worthy of note. The northern and southern halves of the island differ materially, at least superficially. The northern portion is a raised plateau broken by several low peaks. The general plane of the northern half is not horizontal but shelving, with the eastern (and higher) side bounded by cliffs and headlands rising from 200 to 600

feet above the sea, so sheer as almost to overhang the water, while in the little bays at their feet small beaches of sand have formed over the madriporic ledges. The entire northern half is composed of a metamorphosed coral known locally as "casajo," covered here and there to a depth of a few feet with a reddish sandy clay which gives place in the peaks to a whitish clay of a chalk nature. Underlying the surface clay is a stratum of mixed materials—limestone, gypsum, clay, calcareous sand, and quartz in amalgam.

There are distinct coralliferous limestone terraces in the faces of the cliffs on the eastern side of Guam, marking the position of the former sea levels, and indicating the periods of rest during the elevation of the island; and where these are not so distinct, caverns along the vertical faces of the cliffs indicate the former lines of sea level. At places five distinct terraces can be recognized. The lower part of the face of the cliffs is riddled with crevasses, and at a higher level, on what appears to be the fourth or fifth terrace, there are numerous caverns. Some of the coralliferous limestone is stratified, dipping toward the sea; other parts nearer the northern extremity of the island show evidence of great disturbance, probably caused by a comparatively recent volcanic outburst.

Along practically the entire coast of Guam the madriporic flats form a submarine shelf visible at low tide. Talage Bay, at the extreme northern end of the island, is an immense sandy flat, flanked by a broad reef platform full of irregular coral lumps, which extends quite a distance down the west coast. Along the central western coast the great reef flat is broken here and there by indented bays and jutting headlands. Orote Peninsula and Cabras Island on this coast are composed of elevated coralliferous limestone containing well preserved fossils. These show no signs of metamorphism as do those further south

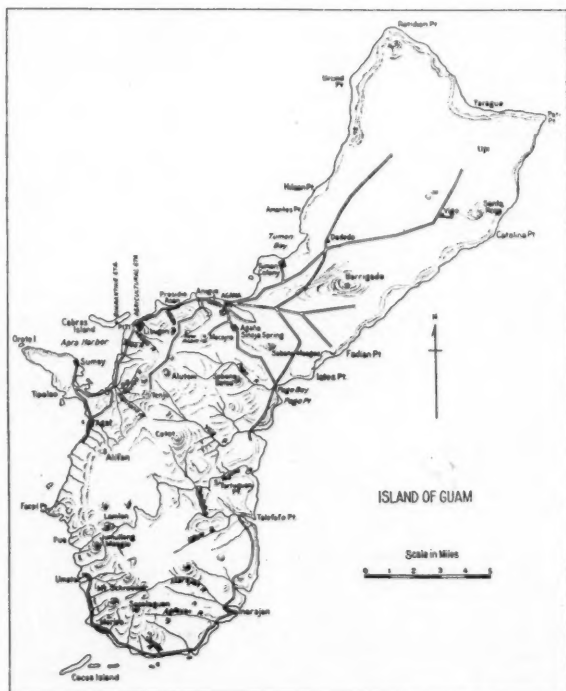


where the limestone came in contact with volcanic rock. The fossils are, however, highly calcified, and their hardness and the crystallization of the rocks would seem to indicate considerable age. The limestone of Cabras Island is deeply pitted and honeycombed, filled with pot-holes and funnels, covered with stalactites.

The southern half of Guam is quite mountainous, particularly because of a ridge along the west coast. It is partly coral and partly of a semi-basaltic nature, covered with a rich, fertile, top soil. Indented here and there with estuaries, it also contains several massive headlands of limestone or basalt. Near Inarajan and Talofofo on the southeast coast are caverns of considerable extent hollowed in the limestone, and containing many stalactites. One curious inland section resembles the "bad lands" of our

own Dakotas, covered as it is with columns of a reddish-tinged limestone wind-carven into bizarre shapes. The southern half of the island in the words of Alexander Agassiz (who visited Guam in the Albatross) is "a volcanic massif which has burst through the coralliferous limestone."

All the mountain peaks are probably of volcanic origin. In some of them the outlines of the craters may still be traced and the lava presents the same appearance as in recent volcanoes elsewhere. Surrounding the bases of the mountains are ancient coral reefs, the margins of which, in contact with the volcanic products, have in many places been converted into crystalline limestone, showing evidence of volcanic activity after the whole island had been raised from the sea. (This metamorphosed coral or "cascajo" is a widely used building material.) It







*Courtesy of "The Military Engineer."*

AGANA, THE CAPITAL CITY

With seven thousand inhabitants, Agana is the largest town on the island. It was an ancient center of Chamorro life and the site of the early Spanish mission. Today, it is a clean and modern town, seldom equaled in the South Seas.

would require only a very slight elevation to convert into dry land the very extensive reef flats along the west coast which are covered at high tide by only a few feet of water. The bottom between the shore and the barrier reef is perfectly level and is covered with very fine sand.

Guam is practically destitute of minerals or useful rocks except for the ubiquitous "cascajo." Lime, of course, is burned and used in mortar. A heavy, hard limestone rock known locally as "Jomon" is used for fire brick. One finds a soft, smooth, fine grained, pale green, mineral-like substance called "Lauka," which is worked with iron tools

like a hard wood. Quartz is plentiful. In certain localities nodules of flint are found similar to those from European chalk formations. Gypsum occurs both in pure veins and mixed with other materials. An inferior lignite has been found in one or two places. There are no metal-yielding deposits although a few minute patches of iron ore have been discovered. Some bits of gray clay look as if charged with an oxide of iron. But all these are in very minute quantities. Guam is primarily and almost entirely an island of coral and lava, cast up ages ago from the depths of the Pacific and surrounded with reefs of the tiny polyp.

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Water is the only mineral which man can see alter from a liquid to a solid without being effected by the change in temperature necessary to produce this. The crystals in quick freezing form horizontally, which makes what we call "India-rubber ice;" later they become vertical and thin ice, instead of bending, will break; the cleavage line being along the plane of the crystal.

## THE ROMANTIC HISTORY OF MONAZITE

By EDWARD CAHEN, A.R.C.Sc., F.I.C., F.C.S.

(Author of "The Mineralogy of the Rarer Metals")

A great deal of interest in collecting minerals is to know to what use they are put in commerce. In my own collection there is a little shallow drawer full of small bottles of sand from all over the world. These illustrate the gas mantle industry and the various industries that have been and might conceivably be developed from the by-products.

When Aufr von Welsbach, after much patient research, discovered that the oxide of thorium, one of the scarcest of the rarer metals, when rendered incandescent emitted a far brighter light than any other known substance, the only source of supply was several rare thorium minerals to be found in Scandinavia. It was obviously a commercial impossibility to start making gas mantles from such a mineral as thorite. The painstaking German was not to be beaten by such a difficulty and a search was instituted for another source of supply. Before very long, success attended their efforts as a beautiful, honey-brown sand was discovered in quantity on the shores of Brazil. This was carefully examined and found to contain some 6 per cent of the thorium compound wanted (an excellent percentage considering the large amount of sand available). This discovery the Germans kept secret, while ship after ship went to Brazil, on some excuse or another, which loaded the sand into their holds, as ballast, for the homeward trip. It was a long time before the Brazilian Government woke up to what was going on and when they did they immediately proceeded to levy a small tax on the export of the sand, a tax which the Germans, needless to say, willingly paid. This sand was Monazite (from the Greek word meaning "to be solitary"), a name given to it from its supposed rarity. We shall see what a misnomer this turned out to be.

Once furnished with a comparatively cheap source of supply of thorium, it was not long before Germany was able to capture the world monopoly of gas mantle making. But the Germans having

shown the way, monazite began to be discovered in many other localities, notably in North and South Carolina and at Travancore, in southern India. The Travancore sands, discovered in 1909, proved to be much richer in thorium than those from other sources and they are the most important deposits known today. Prior to 1914 these sands also fell into the hands of the Germans, who could not afford to have rivals in their monopoly. The outbreak of hostilities, however, severed Germany's control and the Indian sands were acquired by Messrs. Hopkin and Williams (Travancore) Ltd., and what is still more amazing, the market, a free one, shifted from Hamburg to London.

Monazite is found practically all over the world, either in the form of sand in the river beds or on the seashore, or as a solid crystalline mineral. The sands are derived from the decomposition of pegmatitic rocks. In my own collection I have specimens of sand from Brazil, North and South Carolina, Travancore, Federated Malay States, North Nigeria, Ceylon, Western Australia, New South Wales, and the Gold Coast. Also rock specimens from the Transvaal and New South Wales, the latter a beautifully crystalline specimen in quartz.

Monazite is essentially a phosphate of cerium, containing small quantities of other rare metals the most important of which is of course, thorium.

Before export, the sand is rid of its impurities to well over 90 per cent by means of washing it on a specially constructed rocking table designed for this purpose to imitate the washing action of the tides. Then it is passed through a magnetic separator, a most ingenious if costly apparatus. The sand is fed on to a moving belt which passes under electromagnets of varying strength, which pick up the minerals composing the sand and deposit them into several different boxes. In this way honey-colored monazite is separated from red garnets, black ilmenite, and pale-brown zircon. These by-

products are accumulating to an alarming extent in India, and it is difficult to see how they can be utilized commercially though there is a hope that at some future date a use may be found for them.

The annual world consumption of mantles, some ten or twelve years ago, was estimated roughly at three hundred million. Allowing half a gram of thorium oxide for each mantle and an average yield of 5 per cent from the sand, the world's consumption of monazite figures out at 3,000 tons each year, an amount which agrees fairly well with the average annual production of the sand as shown by statistics. When it is realized that every hundred tons of monazite not only produces five tons of useful thorium but also some sixty tons of cerium earths, for which there is as yet but little use, it will be seen that the future of the monazite industry lies in the proper utilization of its by-products. Only 1 per cent of cerium goes to the manufacture of the mantles. A further small quantity is absorbed in the manufacture of pyrophoric alloys, known to the smoker as "flints" which he buys to replenish his automatic cigarette lighter. Fused in an electric furnace together with iron these alloys contain about 70 per cent of cerium metals and the rest iron. These alloys were discovered by Auer von Welsbach in 1907 and were at first made exclusively in Austria and Germany, but during the war they were manufactured in the United States. From 1,800 to 2,800 flints can be produced from one pound of alloy. About 300 tons of cerium salts are used annually for steeping the carbons of arc lamps, as it is found that they burn with a steadier and brighter light if so treated. An infinitesimal quantity is used therapeutically, but this is too small to take into consideration.

We now come to the zircon sand from the magnetic separator. The hope of using this is a faint one. I have a letter dated March, 1925, from the Curator of the Mining Museum in Sydney in which he says: "My information from London is that no zircon is used in Great Britain and that zircite (a refractory material made from zircon) is out of favor, and from America that the world's consumption does not exceed eight tons annually." Not a very hopeful outlook for a by-product I must admit.

The utilization of the black ilmenite in the manufacture of white paint sounds like an inventor's dream, but there is no real reason why the ilmenite from the magnetic separators should not be used for this purpose. In Norway white paint is actually being prepared from ilmenite and sold under the name of "Titanvit." It is admirable for use in towns or for laboratory paint work, as it retains its whiteness, where white paints soon discolor owing to the sulphur compounds in the atmosphere. Being considerably lighter than white lead it goes further. Should white lead be prohibited for the manufacture of paint, as it is to be hoped will one day be the case, here we have a substitute which is in every way as good and even better. The question of the cost of titanium paints is not a serious one, for if more were used the lower would be its cost. As it is today the cost is by no means prohibited and in a modest laboratory where I was researching a few years ago the roof was painted with this "Titanvit" and with great success.

The possibilities of making use of all of those by-products of monazite, and I have mentioned only some of them, seems to me a very alluring one and it is to be hoped that one day we may see all of them in common daily use.

Gold has been found in every province of Canada except Prince Edward Island.

The largest magnetite mines in America are at Mineville, N. Y.

## A COMPILATION OF GEM NAMES

By GILBERT HART

P. O. Box 2005, Birmingham, Ala.

Mr. Hart and ROCKS AND MINERALS will be glad to have readers send in additional gem stone names not here included or suggestions as to any corrections in names which they believe should be made.

This is a continuation of the very interesting compilation of gem names (the largest ever printed) made by Mr. Hart, the first installment of which appeared in the December, 1927, issue of the magazine. This list will be continued until completed.—The Editor.

**Babbel Quartz**—quartz, crystals with flat triangular pyramids growing on the pyramidal faces of large individuals.

**Baffa Diamond**—quartz, rock crystal from Baffa, Scotland.

**Bahia**—diamond from the Bahia District of Brazil.

**Balas**—spinel, rose-red to pink.

**Balas Ruby**—spinel, rose-red to pink.

**Ballas**—diamond, spherical diamonds with radiated structure.

**Bamlite**—sillimanite.

**Banded Agate**—quartz, cryptocrystalline, colors in wide bands.

**Barite**—orthorhombic, tabular, pale colored to colorless, hardness 3 to 3.5, specific gravity 4.49, sulphate of barium. Other names: **Bologna Stone**, **Cawk**, **Michel-Levynite**, **Wolyn**.

**Barklyite**—corundum, sapphire.

**Basanite**—quartz, velvety-black, flinty.

**Bastite**—bronze, often partially serpentinized.

**Barstowite**—danburite.

**Beckite**—quartz, silicified coral or fossiliferous limestone.

**Beekite**—quartz, see beekite.

**Bemiscite**—feldspar, salmon-colored, from Bemis, Me.

**Benitoite**—hexagonal, blue, hardness 6.5, specific gravity 3.65; titanosilicate of barium, rare mineral found only in California.

**Beryl**—hexagonal, usually in prisms; color greens to blue, rarely red or yellow; hardness 7.5 to 8, specific gravity 2.7; silicate of aluminum and beryllium; gem varieties: **Aeroides**, **Amethyst**, **Basaltine**, **Aquamarine**,

**Aquamarine**, **Chrysolite**, **Bixbite**, **Caesium Beryl**, **Canary Beryl**, **Chrysoberyllus**, **Chrysolithus**, **Davidsonite**, **Emerald**, **Golden Beryl**, **Goshenite**, **Heliodor**, **Hyacinthozontes**, **Morganite**, **Peruvian Emerald**, **Roseterite**, **Siberian Aquamarine**, **Smaragd**, **Spanish Emerald**, **White Emerald**; (2) also used in olden times for yellowish sard, especially referring to engraved gems; this use is obsolete.

**Beryllonite**—orthorhombic, habit prisms; pale yellow; hardness 5.5 to 6, specific gravity 2.84; phosphate of beryllium and sodium.

**Biotine**—anorthite from Mount Somma, Vesuvius, Italy.

**Bishop's Stone**—quartz, amethyst.

**Bixbite**—beryl, rose red, from Utah.

**Black Amber**—jet.

**Black Garnet**—andradite, dark green to almost black.

**Black Lava Glass**—obsidian.

**Black Opal**—opal in a dark matrix; (2) opal with vivid dark colors.

**Bleu du Roi**—corundum, ruby, is the French name for King's Blood.

**Blood Agate**—quartz, cryptocrystalline, banded in pink and salmon or flesh-red from Utah.

**Blood Jasper**—quartz. See bloodstone.

**Blood Stone**—quartz, cryptocrystalline jasper, dark green plasma spotted with red jasper.

**Blue Chrysoprase**—chalcedony stained blue by chrysocolla.

**Blue John**—fluorite, dark blue with violet tinge.

**Blue Malachite**—azurite.

**Blue Moonstone**—chalcedony, blue, from Death Valley, Calif.

**Blue Opal**—lazulite.  
**Blue Peach**—tourmaline, slate-blue, and very fine grained.  
**Blue Rock**—Lapis lazuli.  
**Blue Sapphire**—corundum, blue.  
**Blue Schorl**—octahedrite; (2) tourmaline, blue.  
**Blue Spar**—lazulite.  
**Blue Spinel**—spinel, blue or light bluish.  
**Blue Talc**—cyanite.  
**Blue White**—diamond of the highest grade.  
**Blue Quartz**—iolite.  
**Bobrowska Garnet**—grossularite.  
**"Bohemian"**—usually refers to a quartz gem of color indicated in gem name following.  
**Bohemian Diamond**—quartz, rock crystal.  
**Bohemian Garnet**—pyrope, dark blood red.  
**Bohemian Ruby**—quartz, rose red.  
**Bohemian Topaz**—quartz, yellow.  
**Bologna Stone**—barite, globular, phosphoresces when heated.  
**Bonamite**—smithsonite, translucent, apple-green, from New Mexico.  
**Bone Phosphate**—apatite, a general term for amorphous phosphates.  
**Bone Turquoise**—teeth of fossil animals stained blue by iron phosphate.  
**Bornite**—isometric, massive; color brown to red, tarnishes within a few minutes to blue; hardness 3, specific gravity 4.9 to 5.4; sulphide of iron and copper.  
**Bostonite**—serpentine from Quebec.  
**Botryolite**—datolite, botryoidal.  
**Bottle Stone**—moldavite.  
**Bowenite**—serpentine, unusually translucent, rich cream color.  
**Brait**—diamond, applied to uncut stones.  
**Brazil Diamond**—quartz, rock crystal.  
**"Brazilian"**—applied to true gems from Brazil, but more usually to topaz or tourmaline of the color indicated by the gem name following.  
**Brazilian Aquamarine**—topaz, greenish.  
**Brazilian Chrysolite**—tourmaline, green and transparent.  
**Brazilian Diamond**—diamond from Brazil; (2) quartz, rock crystal from Brazil.  
**Brazilian Emerald**—tourmaline, green.  
**Brazilian Pebble**—quartz, rock crystal.  
**Brazilian Peridot**—tourmaline, yellow-green.  
**Brazilian Ruby**—topaz, rose-red to pink, may be either a natural tint

or one obtained by heating a dark-yellow topaz; (2) spinel, light rose-red.  
**Brazilian Sapphire**—tourmaline, blue; (2) topaz, light blue to greenish.  
**Brazilian Topaz**—topaz, golden to reddish yellow; (2) quartz, smoky changed to yellow by heating.  
**Brecciated Agate**—fragments of variously colored chalcedony recemented by chalcedony.  
**Brodbergite**—an andradite garnet from Sala containing a large amount of magnesia.  
**Briancon Diamond**—quartz, rock crystal, from the southeastern section of France, cut in city of Briancon.  
**Brighton Emerald**—green bottle glass, thought to have been intentionally placed on the beach of Brighton, Eng.  
**Brilliant**—diamond, when cut in brilliant form.  
**Bristol Diamond**—quartz, rock crystal from Cornwall, Eng.  
**Bristol Stone**—quartz, rock crystal.  
**Bronze Corundum**—corundum, shows distinct asterism in natural or artificial light, color bronzy to metallic, often dark to almost black.  
**Bronzite**—enstatite, green with bronzy luster.  
**Brookite**—orthorhombic, habit tabular; color brown; hardness 6, specific gravity 4.0; titanium dioxide; also called **Arkansite**.  
**Brown Coal**—lignite.  
**Brown Jacinth**—Vesuvianite.  
**Brown Spar**—ankerite from Chester Co., Pa.  
**Bucholzite**—sillimanite from Tyrol.  
**Bull's Eye**—labradorite, with dusky sheen.  
**Burma Ruby**—corundum, blood red.  
**Burmite**—amber, fluorescent, from Burma.  
**Burnt Amethyst**—quartz, amethyst changed to brownish yellow by heat.  
**Burnt Brazilian Topaz**—topaz, see burnt topaz.  
**Burnt Stone**—quartz, carnelian especially from ancient ruins when the red color has been ascribed erroneously to burning.  
**Burnt Topaz**—topaz, yellow changed to pink by heating.  
**Buxtom Diamond**—quartz, rock crystal.  
**Byssolite**—quartz, sagenitic, containing fine hair-like fibers of greenish asbestos or actinolite.  
**By-Water**—diamond, yellow tinted.

## GARNET

By CHARLES W. HOADLEY  
Englewood, N. J.

Webster gives the following definition under garnet; i.e., "Fr. *grenat*, Pr. *granat*; Sp. *granate*; Italian *granato*; Lat. *granatus*. From the Latin *granatum*. Pomegranate, from *granatus*, having many grains or seeds. Also from *granum*, meaning grain, seed, so-called from its resemblance in color and shape to the grains, or seeds, of the pomegranate.

The mineral usually occurring in symmetrical dodecahedrons of a deep red color (formerly written also *granate*)."

The description given by Webster of this well-known mineral is of course a purely historic description of the origin of the name.

In Poor Richard's Almanac, written in 1733 by Benjamin Franklin, I am quoting: "Men and melons are hard to know." If he had said men and garnets are hard to know the quotation would have been even more pertinent. The average person thinks of the garnet only as a semi-precious stone of a deep blood-red color and found in the jewelry of our great-grandmother's treasure-chest.

The garnet has had an ancient and honorable career as a gem stone, even being referred to in the Bible as carbuncle; but I have said enough about its history, and will get down to facts.

Garnet is essentially a silicate crystallizing in the isometric system. It is holohedral and is a compound of silica with lime, magnesia, iron oxide and alumina, with coloring elements of chromium and manganese; it is a common mineral, and is found in schists, gneisses, crystalline limestones, pegmatites, and eruptive rocks. (1) "In a few cases it shows double refraction, which has led to an attempted reference of its crystals to the 'complex twinning of triclinic individuals,' and there is a difference in the optical properties of garnets which are formed in igneous rocks or in rocks which have been changed by metamorphism, while those formed in crevices from hydrothermal solutions, or in metamorphosed limestone show dif-

ferent physical properties. The former do not show double refraction, while the latter exhibit birefringence."

The garnets are separated into six main classes, each of which are distinguished by chemical composition and a possible seventh class may or may not be included.

**Almandite.**—Iron aluminum silicate is the common garnet found in the schists, gneisses, and pegmatites.

**Andradite.**—Is the garnet found usually in mines. It is an iron lime silicate and occurs in a number of varieties and colors.

**Spessartite.**—Is a manganese aluminum silicate and is usually found in pegmatite rocks, i.e., Branchville and Haddam, Conn., Amelia Court House, Va., Avondale, Delaware Co., Pa., and Nathrop, Colo.

**Pyrope.**—Is a magnesia aluminum silicate. It usually is to be found in serpentine rocks, and the gem quality is from several localities in Bohemia, and the Navajo Reservation in Arizona, where the gem nodules are carried to the surface by ants. Rhodolite, a variety, is from Macon Co., N. C.

**Grossularite.**—Is a calcium aluminum silicate and is often found in crystalline limestones in many colors; white, pale green, amber, honey yellow, pale rose, emerald green, cinnamon brown, and colorless, and occurs in many localities, i.e., Wakefield and Black Lake, Que., Canada, (colorless); Lanzada, Italy, (grass-green); Redding, Conn., (cinnamon brown and red brown). In Morelos, Mexico, we get the rose garnet, and in Vasko, Hungary, brown garnet. Incidentally, Dana says, that not all the light colored garnets are grossularites, as the yellow topazolite garnet and the green demantoid belong to the calcium-iron group or andradite.

**Uvarovite.**—Is the rarest class of garnet and is a calcium-chromium silicate; it is only found in a few localities, like Valtellina, Lanzada, Italy; Orford and Wakefield, Que., Canada; the Ural



Mountains of Russia and Siberia; and the Woods Chrome Mine, Lancaster Co., Pa.

Schorlomite is found at Magnet Cove, Ark., and the Ozark Mountains of Missouri. It is not really a garnet, but is perhaps analogous to garnet as suggested by Koenig.

So much for the six classes of garnet. I am now going to briefly mention a number of so-called varieties of the first classes, almandite, andradite, and grossularite.

The well-known Franklin, N. J., mineral called polyadelphite, is an andradite containing more or less manganese, if we wish to use the word as a variety. Most garnets from this locality are polyadelphite when they contain manganese in sufficient quantity.

The black garnet from the same locality, Franklin, N. J., is andradite as its manganese content is not sufficient to justify any other name.

Aplome or haplome is an andradite having its dodecahedral faces striated parallel to the shorter diagonal, such as the garnets from Cornwall, Pa.

Melanite is a name given to the black andradite found *only* in eruptive rocks, rothoffite is similar to polyadelphite; and bredbergite and jelleite belong under the head of andradite; so does calderite, allo-

chroite, and collophonite. The beautiful yellow topazolite and the green demantoid are classed under andradite also.

Under the grossularite class are a series of beautiful colored garnets, such as essonite or cinnamon garnet, more properly called hessonite; the wiluite, a pale-green stone from Siberia; the succinite (amber colored) from Ala Valley, Piedmont, Italy; the rose garnet, from Mexico, the colorless varieties from Quebec, Canada; romanzovite from Kimito, Finland; and the yellow octahedrons from the Island of Elba (near Italy).

Many garnets, which I have quoted, contain inclusions of some foreign matter, such as quartz and calcite, while I have seen garnets from Franklin, N. J., which are composed of alternate layers of calcite and garnet. We also know that garnet alters in certain cases to chlorite, such as the aphrosiderite, from Michigamee, Mich.

One important thing which has to be remembered is not to judge a garnet by its color. All green garnets are not uvarovite, neither are all red garnets, spessartite. The saying "do not judge a horse by his color" should apply to garnet as well.

(1) "Vade Mecum"—Guide to mineral collections by L. C. Gratacap.

## AN ACKNOWLEDGMENT

R. J. Santschi of Glen Ellyn, Ill., one of our valued members, is having some circulars printed at his own expense advertising the Rocks and Minerals Association. These he will distribute among his many friends and acquaintances. He will endeavor to increase the membership of the Association. As Mr. Santschi is doing this entirely on his own initiative we wish to express to him our very sincere thanks for this very kind expression of his great interest in the Association.

The largest deposit of garnet in the world is in the Adirondack Mountains of New York. The garnets are being mined and are used chiefly as abrasives.

The only known commercial deposit of cryolite in the world is at Ivigtut, Greenland, which is controlled by the Danish Government. Cryolite is used chiefly in the manufacture of soda and alum. Greenland is also noted for its deposits of native iron.

Anthracite coal was formerly mined in Rhode Island, but on account of its high graphitic impurities the mines were not a paying proposition and had to be abandoned.

Clear crystals of quartz, topaz, and the like, should be examined for movable bubbles as this makes the specimen more interesting and attractive.



## BLUE-JOHN FLUORITE

By L. P. BOTTLEY

27 Portland Street

Derby, England

Typical Blue-John Fluorite is found almost solely at the Blue-John Mine, Castleton, Derbyshire, England. Its early use for decorative purposes is instanced by the discovery in the ruins of Pompeii some thirty years ago of two Blue-John vases made from the celebrated and remarkable Twelve-Vein Blue-John Fluorite. This vein, now almost worked out, is found only in the locality known as the "Roman Workings," which connect with the "Roman" shaft in the Blue-John mine at Castleton.

Castleton was certainly worked by the Romans for lead. But from that time up to the 17th and 18th Century, history is silent about Blue-John. It was given its name when discovered or rediscovered by two miners named John Kirk and Joseph Hall. They used the name Blue-John in contradistinction to Black-Jack, the local name for zinc-blende.

Typical Blue-John is found in columnar crystals of Fluorite, both white and blue to black, in distinct veins that occur as nodules and in fillings in cavities in the limestone. Usually these nodules possess a "clay" center. It takes a fine polish and is used as an ornamental stone, often worked into vases, dishes, etc.

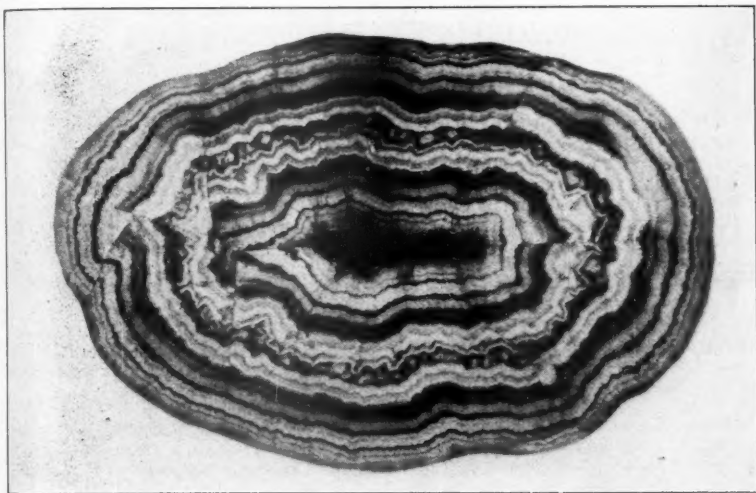
The origin of the blue-color has long been regarded as a mystery. Recent chemical investigations, however, brought forward evidence which by many authorities is regarded as conclusively elucidating the problem of its coloration. In the Transactions of the Mineralogical Society of England for 1919 (115-705), Blount and Sequeira suggested it may be the carbon content (of an extremely dark sample of Blue-John Fluorite from Castleton that gave it its color). In a later paper (No. 65, April 7, 1920), C. S. Garnett carried forward this idea to a successful conclusion. The determination of the carbon content of samples of Blue-John of a less and less deep color showed a successively less proportion of carbon in the lighter-colored samples.

"The powdered mineral when heated with concentrated Sulphuric Acid yielded a black carbonaceous residue, but when heated with a mixture of Sulphuric and Nitric Acids the blue-compound readily oxidized leaving a colorless residue of fluorite and, of course, calcium sulphate. Heated alone, the bituminous odor was very pronounced and a residue of clear colorless fluorite remained."



Blue-John Sections

*Courtesy of J. Armitage.*



*Courtesy of J. Armitage.*

This is an exceptionally large section of a Blue-John Nodule— $23\frac{1}{2}$  inches in diameter

C. S. Garnett further examined the Blue-John in thin sections under the microscope and observed that the coloring matter—bitumen—was not homogeneously distributed in a state of fine subdivision within the crystals of fluorite but occurred as films. These films occur parallel to and in the plane of the crystal cube and also at the crystalline junctures in such a way as to point conclusively to the fact that the coloring matter—bitumen—was deposited as films on the surfaces of the crystals at intervals during their growth. This explains the banded coloration, the depth of color varying according to the abundance and thickness of the films existing in the fluorite.

Bitumen in certain chemical combinations occurs locally as small masses in the form of Elaterite at Windy Knoll, Castleton. It is also well distributed through many of the lower Carboniferous limestone beds of which the surrounding district is composed. The celebrated Ashford Black Marble, which is found at Ashford Dale, twenty miles away, is a limestone heavily charged with bitumen. The bitumen is no doubt of an unknown organic origin.

### THE MINE

The mine at Castleton was not opened to the public until about 1800. Originally the vein was worked when the fluorite was required for fluxing purposes. New roads and other improvements were effected by Micah Clarke in 1836. Flagstones brought from the adjacent Pindale were laid down by Ben Tym. John Tym became the guide in 1857. He was a lapidary of more than local fame and presented to the Stockport Town Corporation, for whom he was curator of the public museum, a window of his own work containing 250 polished sections of Blue-John.

The owners of the mine were for many years the Champions, living at Edale. Later a Mr. Needham acquired the property from whom it passed to C. Markham of Chesterfield, Derbyshire. In 1919, Mr. Arthur Ollerenshaw, owner of the adjacent Speedweel Mine, purchased the rights.

Blue-John fluorite is now almost unobtainable. The Treycliffe workings of the mine are continued chiefly for fluxing purposes. Blue-John is still found sporadically but access to any of these stores is unobtainable by strangers.

## PHOSPHORESCENCE OF MINERALS

By E. MITCHELL GUNNELL

This is a continuation of a series of articles on the intensely interesting phenomena of "cold light." It would please us to have our readers perform some of the experiments outlined in these articles. Those desiring further information are invited to correspond with Mr. Gunnell, who will be only too glad to answer questions. His address is: E. Mitchell Gunnell, 595 E. Losey Street, Galesburg, Ill.

### PART 2—BEING A DISCUSSION OF THERMO-LUMINESCENCE IN MINERALS

Thermo-luminescence, as we have defined it, is phosphorescence excited by the application of a low heat to a sensitive mineral. But as we defined phosphorescence, no appreciable heat emission accompanied the luminosity. These two terms, therefore, seem to contradict each other. But this is not the case. "Cold" light is cold only relatively: all types of luminescence are accompanied by a loss of some heat energy, but this loss is negligible when compared to that of incandescence. True, the quantity of heat evolved varies with the different types of phosphorescence; thus the glow of phosphorus, caused by slow oxidation, gives off more light than the veritably cold glow of zinc sulphide.

With thermo-luminescence, as the name implies, heat is the important factor, but more so as the stimulant of the luminosity than as a result of it. That is to say, thermo-luminescence is quite different from incandescence. In no case of mineral thermo-luminescence does the excitant heat raise the temperature of the phosphor to a point anywhere nearly corresponding to incandescence. Thus it follows that since the heat which excites luminosity in these minerals is far below a "burning temperature," the luminosity itself is due to a slight molecular change in the material rather than to the chemical reaction of oxidation.

To correct a possible misinterpretation of my statements in the earlier article concerning the nature of phosphorescence, I wish to add a few words. I

stated that "animal light" and the glow of phosphorus were not examples of true phosphorescence since they were caused by chemical change rather than molecular change, and therefore were accompanied by a much greater loss of heat. Thus I purposely threw chemi-luminescence from out the category of phosphorescence. The term "phosphorescence" is as broad or as narrow as we wish to make it, and either limitation is correct. If we say the term applies to all forms of light other than incandescence, the chemi-luminescence is certainly included. If, on the other hand, we wish to limit the term to the phenomena exhibited by minerals, then chemi-luminescence must be thrown out, as no minerals glow because of oxidation but only because of some molecular change.

We are now ready to study and demonstrate the phenomena of mineral thermo-luminescence by the unexcelled method of personal experimentation.

Herewith I give a list of those mineral species which best illustrate the phenomena. Not all specimens of any one species are phosphors; the material from one locality may be extremely sensitive to heat, while that from any other place is entirely unresponsive. Thus, in ordering material for experimentation a locality from which responsive material comes should be named. Many of the dealers advertising in **ROCKS AND MINERALS** can undoubtedly supply the experimenter with good specimens at reasonable prices.

### Name of Mineral and Color of Luminosity

#### Localities Which Afford Sensitive Specimens

Albite—Green!!—Virginia, etc.

Calcite—Yellow!!—Fort Collins, Colo.; Joplin, Mo.; Franklin, N. J., etc.

Danburite—Yellow!!—Danbury, Conn.

Dolomite—Yellow—Missouri, etc.

Fluorite—Green, Lilac!!, etc.—Madoc, Ont., Canada; Westmoreland, N. H.; Trumbull, Conn.; Amelia Court House, Va. (Chlorophane); Weardale, England, etc.

Lepidolite — Red!!—Oxford County, Maine, etc.

Oligoclase—White!!—Mitchell County, N. C.

Petalite—Yellow!!—Uto, Sweden, etc.

Spodumene — Orange!! — Oxford County, Maine, etc.

The method of procedure for demonstrating the phenomena in any of the above minerals is quite simple. Break the material up into small pieces about the size of lead BB shot. It has been observed that fragments of this size glow brighter and longer than smaller or larger pieces. Now place a few of the pellets in a glass test-tube, cork it, and heat over a slow Bunsen burner flame. As soon as the necessary temperature is reached (which, in most cases, is about 200° C.), the fragments will begin to glow with a color depending on the mineral employed. The reason for corking the end of the test-tube is that certain of the minerals (Calcite and Fluorite, for example) decrepitate when heated, that is, fly to pieces. Thus there would be danger of being struck by a hot, flying fragment if precautions against it were not taken. Another and better way is to place the mineral pieces on an iron plate held in place over the burner flame by a ring-stand. But best of all is to throw the fragments on the hot stove lid, or place them in a skillet and heat over the gas burner, or over a small electric stove. Wear a pair of goggles to protect the eyes from flying pieces, and do not bend over too close or else a burn may result.

Most of the tabulated minerals glow with a color peculiar to themselves, as shown on the list. Thus, Lepidolite, always emits a red light; Albite, a green glow; and Danburite a yellow glow.

Fluorite, however, glows blue, violet, green, white, or red, depending on different specimens, either from the same or different localities! Moreover the color of the light obtained has no relation whatever to the color of the mineral itself. The well-known, but unfortunately little seen, "Chlorophane" variety of Fluorite from Amelia Court House, Virginia, is said to be so sensitive to temperature change that it becomes luminous with a green color from the heat of the hand!

It is interesting and important to note that after once being heated, a mineral loses the property of thermo-luminescence. Experiments conducted last year by Professor F. G. Wick proved that exposure of naturally non-sensitive material (especially Calcite and Fluorite specimens) to X-rays made such material sensitive. In the case of already responsive specimens, the X-ray materially increased the sensitivity and brilliancy of the thermo-luminescent phenomena. If the amateur collector has access to an X-ray machine, he can expose his specimens and note the effects of such exposure for himself. Such experiments, however, should be overseen by a physician or a professor who understands the handling of an X-ray machine, as it is a delicate and complex apparatus and one fraught with danger for the inexperienced. Since specimens are practically useless after one heating, it would be wise for the experimenter to conserve his supply of sensitive material. It has been said that the action of the electric spark will restore the sensitivity to some extent, but I cannot say as to the correctness of the statement. However, specimens of most of these minerals are quite cheap and a small piece will last a long time. I suggest that the experimenter crush his specimens into pieces of uniform small size, place these in glass vials labelled with the name of the mineral, the locality whence it came, and the color of the thermo-luminescence, and keep them in a cigar box. In this way the sensitive material will be altogether, and ready for use, instead of being scattered nobody knows where.

If the experimenter uses originality instead of following direction alone he will discover many interesting things. For example, the minerals listed are not the only species known to glow when subjected to heat. Limestone, Aragonite,

Tremolite, Wollastonite, Harmotome, Pectolite, Scheelite, Magnesite, Orthoclase, Beryl, Celestite, Quartz, Strontianite, Topaz, Zircon, Calamine, etc., are all reported to have given positive results when tested. However, do not be discouraged if your specimens are unresponsive because undoubtedly the great bulk of specimen material is unresponsive. You may find only one sensitive phosphor out of fifteen or twenty trials, but in the very uncertainty of results lies the fascination of testing your minerals. After having amassed all sensitive material available, the experimenter can then devise novel methods of demonstrat-

ing the phenomena. One very striking effect will be made by arranging phosphors that glow with contrasting colors in the form of a five-pointed star on the hot stove lid, or in the kitchen skillet. Upon reaching the proper temperature, the mineral fragments will glow with a variety of colors and present a beautiful sight. But beware of getting the face too close, or a decrepitating piece may hit you! Many such effects can easily be devised, and it is hoped that this article, as well as those to follow, will serve to inspire a more widespread enjoyment of what is now merely a scientific novelty.

## THE GEM DEPARTMENT

Conducted by  
GILBERT HART

Each issue Mr. Hart will give in this department information concerning gems and gem minerals. As Mr. Hart invites correspondence relating to the department, letters should be addressed to him as follows:

Gilbert Hart, P. O. Box 2005, Birmingham, Ala.

### GREETINGS

In accordance with a request of the Editor of **ROCKS AND MINERALS**, I am to take over the editorship of the Gem Department. In order that my relations with all the readers may be for the best benefit of both, I sincerely request that any or all of you send me suggestions or criticisms to make this department of the widest interest to gem lovers. Since my personal training is more toward the study of occurrences and determinations, perhaps I will be laying an unnecessary stress on the determination of species and varieties of the different gem minerals and will be rather deficient in the description of the beauties and attractions. If so, do not kindly bear with me, but call my attention to other phases of gem lore which is most interesting to you.

Most gems are minerals, but there are a few which are of animal or vegetable origin. Tabasheer is an opaline silica found in the joints of certain bamboos.

Is possesses many of the opal's characters of scintillating points of color, so that it is sometimes used in the same way as pearl.

Amber is a fossil resin, probably exuded by conifers ages ago, buried in sand and kept in a clear transparent condition. It is often used for beads and articles of adornment but rarely for display (of some peculiar character) as in a pin or brooch.

Some varieties of coal, particularly the brilliant anthracite, have been occasionally used by the jeweler. Jet was once only of coally material, but now this term includes specimens of black tourmaline—a much more durable stone than anthracite and one which holds its polish and always appears brilliant.

Pearls are the most precious of the organic gems. They are secretions made by various shell-fish to cover and ease some irritating particles within the shell. Both fresh and salt water produces pearl-bearing mollusks, the best usually coming from the oyster.

Nacre or mother-of-pearl is a very similar substance (to a pearl) that is deposited on the inner layers of the shell. Its wide surfaces make it an admirable gem for the many large jewels of feminine wear. Abalone is a mother-of-pearl from a large shell-fish of that name, living along the shores of the North Pacific.

Coral is the calcareous remains of the homes of innumerable small animals, whose individual openings are often discernable as pin-holes on its surface. Many kinds of coral are known, and several are used as ornaments, often in their natural condition. Only the red or precious coral, in its peculiar tree-like form, has been adopted for personal wear. It is rarely in a suitable shape for the jeweler's attention, and when used is often in connection with some white gem whose broad surface contrasts beautifully with the branching red of the coral.

Other types of calcareous matter secreted by animals are used for various purposes other than mere adornment. Among such are the elk's teeth of the brethren of that fraternity; shark's teeth as worn by mariners for good-luck pieces; and walrus tusks and ivory which are used in various ways.

An imitative mineral, adontolite, which closely resemble turquoise, is really a fossil bone or tooth which has been impregnated with copper or other green material. It is occasionally sold as "false turquoise."

If you have labeled a specimen "Quartz" there is still room for further

determinative work. An article — "The Nomenclature of Silica" — in the November, 1927, issue of *The American Mineralogist*, subdivided quartz into seven main groups and lists 450 varieties.

Diamonds have been found in many States of the Union; definitely located kimberlite pipes in Arkansas only, but in drift and alluvium in more than twenty other States. Several years ago, Prof. Hobbs made a summary of the occurrences north of the Ohio River and suggested that the probable source of these stones, all of which were found in glacial materials, is in the Canadian "Height of Land" between Hudson Bay and the Great Lakes. Those found south of the Mason and Dixon Line appear to have originated in the pre-cambrian core of the Appalachians, but no definite summary description has been published. The Western occurrences have never been fully correlated, but there are indications of several areas promising to gem prospectors.

While cutting and polishing adds greatly to the beauty of a diamond, one who sees for the first time a parcel of uncut diamonds is amazed by their splendor. A hundred crystals and fragments of a chance lot will show all sorts of colors with natural luster, and when lying on a white paper in the sunlight will glisten in myriad rainbows and sparkle from every angle. The natural luster is even greater than the usual luster of ring-stones, which is somewhat deadened by accumulated moisture and dust.

Pennsylvania has the unique distinction of having within its borders a specimen of practically every mineral found in America.

The largest low-grade gold mines in the world are at Lead, S. D.

The exchange of ideas on cabinets and arrangements of mineral specimens for display is about as timely and interesting as anything in our line could be. Let's hear from a few more of the collectors along this line.

Tilly Foster, in New York, one of America's famous old mineral localities, has been acquired by private individuals, and is not available to collectors any more.

The season when the mineral collections come into their own is with us now. Mineral collecting is an ideal hobby for winter evenings. When you get ready to fill up the vacancies in your cabinet remember the dealers who support ROCKS AND MINERALS. Give them the first chance at your business and tell them where you saw the advertisement.



## NOTES AND NEWS OF MINERALS OF THE RARER ELEMENTS

By O. IVAN LEE.

Mr. Lee will be glad to assist subscribers in identifying specimens suspected of being minerals of the rarer metals or in answering questions pertaining to them. Please write to him direct, enclosing postage if a personal reply is desired, specimens returned, etc. Address all mail as follows: O. Ivan Lee, 2684 Boulevard, Jersey City, N. J.

### THE MINERALS OF SCANDIUM

The rare metallic element, scandium, chemically more nearly resembles aluminum and beryllium than the rare earths, yttrium occupying an intermediate position. However, both are always associated with the rare earths. Scandia,  $\text{Sc}_2\text{O}_3$ , was first discovered by Nilson in 1879 in ytterbia derived from *Gadolinite* and *Euexnite* of Scandinavian origin, hence its name. The mineral *Keilhauite* was soon found to be yet a third source. The element appears to be very widely distributed, celestially as well as terrestrially, but in very small quantities, and it is found most frequently in the zirconium minerals, beryls, titanates, columbites, titanocolumbites of the rare earths, micas, cassiterite, and especially wolframite, but with two exceptions, those mineral richest in this elusive element contain less than 2 per cent. Most yttrium minerals contain scandia, but yttria invariably predominates. Among the minerals containing scandium may be mentioned *Auerlite*, *Cerite*, *Cryptolite* (*Monazite*), *Koppite*, *Mosandrite*, *Orangite*, *Orthite* (*Allanite*), *Pyrochlore*, *Thorianite*, *Thorite*, *Tirconite* (*Zircon*), etc. It appears to be absent, though, from *Fergusonite*, *Eschynite*, and *Samarskite*.

### WIIKITE

Although a Finnish *Orthite* has been described containing about 1 per cent of scandia. Crookes utilized the rare and unique mineral *Wiikite* as a source of scandia for his research on this little known element. This strange and remarkable mineral was found in a feldspar quarry,\* Lake Ladoga, at Impilaks, Finland, associated with *Monazite*, and

seems to exist in at least three varieties, alpha, beta, and gamma, differing in properties and composition. All are amorphous and so complex chemically that no definite formula has yet been accepted to represent the species, although the idealized formula  $\text{FeTiSiO}_5$  has been suggested. The type rich in uranium is called *Wiikite* while that rich in yttrium is known as *Loranskite*. When the mineral is heated, an evolution of gas occurs which is almost explosive in its intensity, accompanied by a white sublimate and a curious fracture. The gas is made up of steam, helium, and hydrogen sulfide. The color varies from yellow-brown through brown to black, the density is 4.85 and the hardness 6. It is partially attacked by acids and completely decomposed by fusion with potassium bisulfate.

### BAZZITE

Another mineral reported as containing scandium together with rare earths, iron and a little sodium, is the species *Bazzite*, found in drusy cavities in the granite of Baveno, Piedmont, Italy, as minute, sky-blue, barrel-shaped hexagonal prisms. It is found on crystals of *Quartz*, and pink *Orthoclase* associated with *Laumontite* and *Albite*. It has a vitreous luster, a hardness of 6.5 and a gravity of 2.8. On heating, it becomes dark and opaque but does not fuse, and is insoluble in acids, hydrofluoric excepted. Fusion with soda ash readily effects decomposition.

### THORTVEITITE

The most remarkable of the scandium minerals and the only one in which this



element is an appreciable and essential constituent, is *Thortveitite*, first described by Schetelig in 1911. Originally, it was found in a pegmatite vein in granite in Ljoslandsknipe, Kirchspiel, Iveland in the feldspar quarries at Saetersdalen, Norway, but subsequently Lacroix reported it from Befanamo, Madagascar, Africa, noting an yttrium free variety which he termed "*Befanamite*." The composition approximates to scandium (yttrium) orthodisilicate, and

the scandia constitutes about 37 per cent of the whole. The mineral is found in radial aggregations of rhombic crystals, the color usually being grayish-green although it may be white or reddish-gray. This specific gravity is 3.571 and the hardness 6 to 7. It fuses with difficulty and is only partially decomposed by hydrochloric acid. The associates are *Beryl*, *Monazite*, and *Euxenite*, with the usual common vein-materials.

\*Now abandoned and flooded.

## THE RADIO-ACTIVE MINERALS OF AUSTRALIA

By M. MAWBY

475 Wyman St., Broken Hill, N. S. W., Australia

Although a number of interesting occurrences of radio-active minerals have been noted in Australia, only two of these have shown any prospect of becoming of economic value. These two occurrences are at Mt. Painter in the Flinders Range in northern South Australia, and at Radium Hill, near Olary, South Australia.

At Radium Hill, the chief radio-active mineral is Carnotite, which occurs as yellow and greenish-yellow encrustations on the faces, joints, and in cavities, of a lode formation, which consists of vanadiferous and radio-active Ilmenite, Magnetite and Quartz in association with Biotite. This ore is concentrated by magnetic and gravity separation.

At Mt. Painter the outcrop of the lode consists of Quartz, Magnetite, Hematite, and manganiferous ironstone associated with a considerable admixture of other minerals such as Monazite and secondary uranium minerals. Occasionally vughs and patches of Fluorspar, Barytes, Amethystine and Smoky Quartz, are met with. The uranium minerals found are characterized by their rich green and bright yellow colors, making very pretty specimens. The uranium minerals found include:

(1) Torbernite—This is the most common mineral and it occurs as emerald-green encrustations and patches on ironstone.

(2) Autunite—Bright yellow.

(3) Zeunerite—Similar in appearance to Torbernite.

(4) Uranophane—Similar to Autunite but of paler hue.

(5) Gummite—Dull yellow mineral resembling gum. Massive.

(6) Fergusonite.

Pitchblende has not been noted but should occur when the deposits have been exploited to depth. Owing to the location of this field in a dry, arid region, it was only accessible by camel teams; but with the introduction of motor transport and efficient means of treatment, the exploitation of this field may yet result in success.

In the northwest of West Australia, two radio-active minerals have been found; but do not exist in commercial quantities as far as known. These are Pitchblende, and Pilbarrite (named after Pilbarra district where it was discovered.) Pitchblende occurs associated with Feldspar, whilst the Pilbarrite is associated with Tantalite.

Pilbarrite is essentially a silicate of lead, thorium, and uranium (hydrated), containing 27.9 per cent  $UO_3$ ; 31.34 per cent  $ThO_2$ ; 17.26 per cent Pb; 12.72 per cent  $SiO_2$ ; 7.66 per cent  $H_2O$ ; besides ceria, yttria, phosphorus, and helium (.38 ccs. per gram). Sp. Gr. 4.68. Yellow, amorphous, and strongly radio-active. In this field Tantalite, Columbite, Euxenite, Microlite, and other rare-earth minerals occur.

Autunite and Torbernite occurred also at the Carcoar Cobalt Mines, New South Wales, associated with Quartz and Glauconite; whilst many samples of copper ore from various parts of Australia have shown radio-activity.

## PALEONTOLOGY DEPARTMENT

Conducted by  
BENJAMIN T. DIAMOND, B.S.

Mr. Diamond will gladly assist subscribers in identifying their fossil specimens or answering any questions pertaining to fossils. Please write to him direct, enclosing enough postage if a personal reply is desired, specimens returned, etc. Address all mail as follows: Benjamin T. Diamond, B.S., 467 Riverdale Ave., Brooklyn, N. Y.

### SPONGES

When using a sponge one hardly stops to think of where it came from or even what it consists of. Even on reflection it is hard to believe that the sponge is a calcareous skeleton secreted by a single or a colony of animals.

From a biologic point of view sponges are aquatic animals of extremely variable form. Typically a simple sponge looks like a hollow attached case penetrated by many canals which conduct water through the wall into the paragastric cavity. The animal feeds itself by drawing water into these canals absorbing any food

particles that may be present in the water and forcing the water out of the osculum.

From a palaeontological point of view only the skeleton of the sponge is of consequence, for that is the part which is preserved. The skeleton may be simple or compound, depending upon whether its inhabitant led an isolated existence or whether its inhabitants were colonial. The skeleton consists of calcareous spicules, of almost pure calcium carbonate, which are deposited in a crystalline condition; each spicule behaving optically like a single crystal. The siliceous spicules are composed of colloidal silica which is deposited in concentric lamellae alternating with organic lamellae.

There are other groups of sponges; the Myxospongae and the Ceratospongiae which are never found as fossils since their skeletons are made of organic material which does not preserve well.

The two groups which are preserved and found as fossils are known as Silicispongae or Calcispongiae, depending on whether the skeletons are siliceous or calcareous.

Since sponges as a rule are poorly preserved and difficult of determination, I shall just consider a synopsis of the important genera and species, of the fossils which are abundant in certain horizons, therefore being index fossils or horizon markers.

#### *Astylospongia Praemorsa*—Goldfuss

Ball-shaped with shallow depressions on top. From the top of this depression radiate shallow furrows irregularly over the sides. The ball is pierced with many large holes. Found in Niagaran of the Silurian.

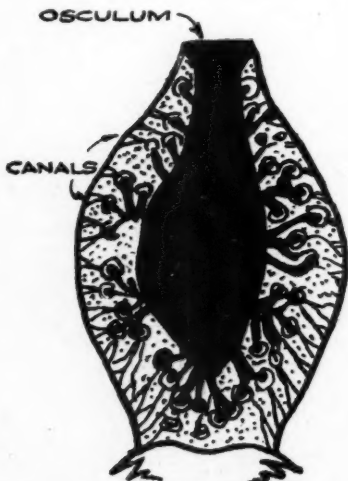


FIG 1  
A TYPICAL SPONGE

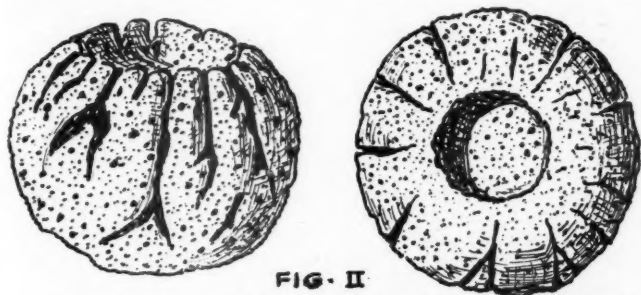


FIG. II  
**ASTYLOSONGIA PRAEMORSA**

*Hydnoceras tuberosum*—Conrad

Large, regular rows of nodes or tuberosum usually eight in number longitudinally, surface reticulated by lattice-like spicular bands. Found in the lower and middle Chemung in New York.

*Brachiospongia digitata*—Owen

Central flattened body possessing from eight to eleven radiating arms. The

arms go out horizontally for a short distance then turn at right angles and rise nearly vertically. Found in the Trenton of Kentucky.

*Astraeospongia meniscus*—Roemer

Vertical section of crescent-shaped, star-shaped. Spicules vary conspicuously, especially on the concave surface. Found in the Niagaran.

## A UNIQUE MINERAL LOCALITY IN OREGON

By DR. HENRY C. DAKE

793½ Thurman Street, Portland, Oreg.

Located in the Crooked River Canyon, near its entrance into the Deschutes River, Central Oregon, is an unusual and unique occurrence of Opal. Crooked River has here carved a picturesque canyon several hundred feet in depth through the layers of Columbia River lavas (Miocene Age).

The opals are found lying in the pool surrounding a cold-water spring known as "Opal Springs," located near the bottom of the canyon. While the opals found here are not of gem quality, they are of an interesting—nearly transparent—variety called "water" opal. Most of the specimens are nearly colorless or slightly blue. A few near "fire" opal have been found. They range in size from quite small up to about an inch in

diameter and are generally water-worn and rounded, similar to the opal found in stream beds.

The water issuing from the spring is of sufficient volume and force to carry the opals up from depth and deposit them in the saucer-shaped bowl surrounding the spring. The water being quite clear one can often observe an opal being carried up to the surface. The opals, no doubt, occur in the cavities of the lava from which the water issues, and are eroded out and thus carried to the surface, where they can be readily collected.

The locality being near the Dalles-California Highway, can be easily reached by a short walk. The occurrence is unique in that the supply of opals is self-replenishing.

## CRYSTALLOGRAPHY

Conducted by  
GILBERT HART

P. O. Box 2005                      Birmingham, Ala.

This is the first of the series of articles which will be contributed by Mr. Hart upon this rather difficult department of mineralogy. Mr. Hart's intention is to present this subject in untechnical language which will enable the reader to obtain practical information regarding the Systems of Crystallization, that he could obtain by independent and unguided study outside of the classroom.

Crystallography may be defined as the science dealing with the forms, properties, and structures of crystals. All solid matter is either amorphous or crystalline; amorphous matter is such that all properties are the same in all directions, while in crystalline matter some properties, especially physical properties, vary with the direction. Amorphous matter is also without external forms which is definitely related to the structure, and is usually of an entirely uniform structure. When crystalline matter is allowed full freedom of development, the complete unit is bounded by certain definite faces which have an exact relation to the molecular structure.

The properties of crystalline matter can be divided in two types; in the first type, properties which pertain to the mass of material the physical properties are uniform throughout the crystal. In this class are such as specific gravity, specific heat, melting point, recrystallization points, etc. In the second type, linear properties, the absolute value of the property varies with the direction in the crystal in which the property is measured. Here belong such as elasticity, cohesion, optical and thermal properties, electric and magnetic relations, etc. Directional properties are the same in parallel directions in a crystal, and may be repeated symmetrically about some axis or plane of the crystal with equal values.

Crystallization may take place from solutions by a supersaturation of the crystallizing substance in the solvent. From fusion of a substance crystals may form. In some cases crystals are formed directly from a vapor without any in-

tervening liquid stage. Finally crystals grow from a nucleus to recognizable size apparently by accretion in the solid state.

The word crystal is derived from the Greek for ice, and was applied by the Roman philosophers to Alpine quartz, which they considered to be ice frozen extremely hard and unmeltable by the very cold winters of these high mountains. Early in the seventeenth century crystal was applied to any natural object which showed a fairly uniform character, and which was bounded by definite faces. For many years the relations of the faces of crystals were carefully determined by the scientists, who developed a system of names and numbers for faces of the various types of crystals. The relations between crystals of the same species of mineral, but of slightly different shapes were studied, and the laws of crystal formation worked out in mathematical detail. These early workers discovered the general rules of symmetry which will be later discussed, and applied them in the measurement and classification of crystals. With the growth of chemistry, the crystallographer was engaged in correlating the crystal measurements with the chemical composition.

In 1835 the first strictly mathematical treatment of the laws of crystalline faces was published; its conclusions were based on the very extensive data of the former writers, comparing the observed facts with the results of mathematical computation. This ushered in a period in which the strict geometric relations of crystal faces, of axial ratios, and of symmetry held the place previously occupied by the mere measurement and de-

scription of the crystals. Still further laws were discovered, and the observed relations based on the limited experiences of earlier thinkers were mathematically proven correct. Certain limits to the number of possible types of crystals were found by application of the mathematical thought. Simplification of the nomenclature of crystal faces was made possible, and close relations between the vastly different appearing holohedral and hemihedral forms were shown to exist.

More recently the discovery of X-ray analysis has placed an entirely new aspect before the crystallographer; and to-

day he deals with the atomic structures and molecular arrangements within the very heart of the crystal.

In the first stages of crystallography, natural minerals were almost the only subjects of search; later artificial crystals were closely studied, particularly because of the accuracy of control of sizes, and of purity. The X-ray is being used to determine the characters of such artificial crystals as the useful metals, as well as to trace out the molecular structures of the minerals with all their intricate past history.

## MINERAL LOCALITIES OF MAINE

By CHARLES F. MARBLE  
*Ridlonville, Maine*

### THE HARTFORD CHRYSOBERYL PROSPECT

A few years ago a hunter, while on one of his trips in the town of Hartford, Maine, discovered some peculiar crystals in a boulder, which on investigation proved to be Chrysoberyl. The discovery aroused considerable interest and quite a few people have visited the place. Among others were Prof. Charles Palache of Harvard University and Mr. Loren Merrill the veteran of the Mount Mica Mine in Paris, Maine.

The deposit is about half way up on the face of a vertical cliff about 150 feet high and the talus at the bottom is very steep and rough. Some of the masses that have split off are as large as a small house.

Up to the present time the only way to get specimens is to go to the foot of the cliff and search among the boulders that have been split off by the action of the frost.

The deposit seems to be a pegmatite formation but has certain characteristics which may be the result of metamorphic action.

The crystals of Chrysoberyl lay in or near the quartz and usually very close to a "slickenside" surface. Though some of the crystals are fairly perfect most of them are somewhat broken many of which have the cracks filled in with quartz as commonly seen in beryl and tourmaline in other places. Some of the crystals are fairly clear but nothing of real gem quality has as yet been reported. The color is a pale yellowish-green and one crystal was reported to be nearly two inches in diameter and one half inch thick but the majority are much smaller.

The pegmatite has been traced for about one half mile in a direction a little north of west but the Chrysoberyl seems to be confined to one small place in the face of the cliff.

The dominant feldspar is one of the plagioclase series, possibly Oligoclase. Other minerals observed were Garnet, Black Tourmaline, Muscovite and a few very small crystals of pale bluish-green Apatite.

So far as the writer can learn, this is the richest deposit of Chrysoberyl in the State and possibly in the whole country.

## THE BEGINNER'S CABINET

### A Department for Young Collectors

Conducted by  
ILSIEN NATHALIE GAYLORD

#### MARCH CLAY AND RUBIES

March! A stirring of spring in the air, but clinging sticky clay underfoot. Most annoying it is! And yet, this same clay has a wonderful history. Despise it as we may, it is connected like a distant relation to that great glowing ruby in the English crown. Indeed, there are those who believe that nature actually made that ruby out of clay. However that may be, at least the same mineral, alumina, forms the principal part of both rubies and clay.

Now let us see just how it is that rubies, which cost three times as much as diamonds, and common humble clay are related. And also from where so much clay comes. It is an interesting story. It will take only a few words to explain it, but it took millions of years to happen. That granite rock over there knows all about it. It was there at the time. Do you see the pink particles scattered all through it? Those particles are feldspar. Really, they are little crystals only partly formed.

The reason why those little feldspar crystals never grew to be large fine ones is this. Millions of years ago nature thrust that granite up from inside the earth. It was so intensely hot down there, that the granite was molten. Some of it was pushed up as the heart of great mountains. And some of it filled the cracks between the rocks.

So fast the granite cooled, and so many other kinds of crystals in it were trying to grow there too, that the little feldspar crystals were cramped and stunted. There was not nearly enough space for them to develop. And so forever they were doomed to remain these pink crystal blotches in the rock.

While all this was happening, the rains and frost and winds were wearing down the mountains. It took long ages to do it. But at last the hidden granite was laid bare. Now the weather is slowly wear-

ing it away too, and the little feldspar crystals in it. It is these crystals which powder into clay.

Now comes the relation to the rubies. Those little feldspar crystals are made of certain minerals. Alumina is one of them. As the crystals wear away, the alumina in them becomes the dust which makes clay. And it is out of alumina that nature forms her rubies. Thus, although not of the immediate family but like a poor relation, the clay claims kinship with the rubies. As the ages pass, the earth is continually absorbing her minerals and then thrusting them up again as new crystals and rocks. For this reason some geologists believe that the great beautiful rubies which men find, have been made from the alumina that once was clay.

Whether or not the rubies in the king's crown were made of clay, at least some of his palaces are made of it in the form of bricks. The dishes on his table are made of clay too. Sevres, the most delicately beautiful china in the world, is made of white clay. Very carefully the soft clay is shaped into frail cups and dishes. Then they are baked in an oven built for that purpose.

From old cave days people have eaten out of dishes made of clay. The Indians of today still mold and bake this ancient earthenware in the old primitive way. But we have learned how to make it into china which is wonderfully delicate and beautiful. All this, and much more, our March clay has done for us. After all, we owe it a large debt for the comforts it has given us.

But just a word more about feldspar before we go on to the study of other minerals. Those little pink crystals in the rock are not the only form of feldspar. It has many forms. Two of them you will surely want for specimens in your cabinet. One is called Amazon-stone. They are beautiful green crystals



which come mostly from Pike's Peak, Colo. These are the crystals which nature sometimes mends when they become broken. Now and then one is found that is broken straight across, with one half of it crowded out of place or turned part way around and then stuck fast again. The crack probably came when some sharp earthquake running through the mountains suddenly snapped the stone in two. Then nature had to mend it again. There is no knowing what tremendous pressure and vast time it took to do it. Even so, it does not seem to be very well done.

Another variety of feldspar that you will surely want is Labradorite. It is a most surprising stone. Usually it seems to be just a piece of uninteresting gray rock. Then suddenly, as you turn it about in the light, gorgeous colors flash through it. Brilliant copper shades, purples, rose, and peacock blue. But even as you watch it, the colors are gone. You turned it slightly.

However, back they come again, as once more you face that particular spot to the light. Soon you will learn just how to hold your specimen so its beautiful colors will show. When you send to a dealer for Labradorite, you must be sure to tell him that you want a piece which will flash these colors. Not all Labradorite rock does this. Only where there are little flaws or minute crowded crystals of some other mineral will the colors show. As you can guess, this feldspar is called Labradorite because it was first found in Labrador.

### ROYAL RUBIES

Now shall we have a little talk about the rubies themselves? Strange histories some of these beautiful glowing stones have had. Men have fought to possess them, and thieves have stolen them from sacred places on church altars. They have been hidden in the earth for safe-keeping, and discovered long years afterward. Kings have pawned them to raise money, and rogues have plotted to get possession of them.

For centuries immensely wealthy rulers of India and Persia have used these rich gems lavishly for decoration. One ruler had a great tree built of gold, and the fruit on it was made of clusters of precious gems. Bright red rubies formed part of the fruit. Even in those days \$150,000 was paid for a fine ruby. At

that rate what would such a gem cost today?

But a golden tree filled with jewels for fruit was not only fancy of those olden rulers. One great Emperor of India had a magnificent throne built in his palace. The seat of the throne was white marble studded with jewels. Over the seat was a canopy, with bands of diamonds and pearls and with a pearl fringe around it. All the jewels of these Far Eastern rulers were of the finest quality.

The pillars which upheld the canopy of the throne were set thick with gems, and the legs of the seat were of gold. But the most magnificent part of the throne was a jeweled peacock standing on the canopy. A peacock was an important religious symbol to the rulers of that age.

The tail of this gorgeous peacock was set with sapphires and other gems. Its gold body was also covered with them. On its breast a great ruby blazed. Beside the peacock were immense bouquets of flowers made of jewels of all colors. Inside and out the canopy was set with rows upon rows of flashing gems.

Over one hundred rubies were set in this wonderful throne, besides all the diamonds and other jewels in it. It was like a blaze of light. The great Koh-i-noor diamond which now belongs to the English crown jewels was one of the peacock's eyes, so legend tells us. Another famous diamond formed the other eye.

In the tail of the peacock were great beautiful sapphires. They will interest us, too, for sapphires are made of the same alumina that makes rubies. But while rubies are a clear blood-red, sapphires are a deep velvety blue. How can two stones be made of the same mineral and yet be so different in color? Because a tiny bit of iron slipped into the ruby crystal when it was forming. That gave it its red color. Some other mineral dyed the sapphire a beautiful blue.

To better understand about these lovely gems, we must stop a moment to study about corundum. When alumina is crystallized it is called corundum. The perfectly pure corundum crystals are clear like diamonds. But tiny bits of other minerals often slip into the clear corundum crystals while they are forming. These minerals dye the crystals and so we have the red ruby, the blue sapphire, the "oriental" green emerald, the



"oriental" yellow topaz, and the "oriental" purple amethyst. Every color of the rainbow is in these lovely corundum crystals.

We have to say the word "oriental" before the corundum emerald, topaz, and amethyst, because the true emerald, topaz, and amethyst are made of very different minerals. These green, yellow, and purple corundum crystals only look like them. But the ruby and sapphire are true ones, for they are never made of anything but corundum. This makes the ruby and sapphire close relations, sister stones.

Sapphires are expensive gems, too, but more abundant than rubies. Being formed of the same mineral, both rubies and sapphires are often found together in nature. The rubies shade from pale pink to rich red. But the best ones, those which are bright blood-red are found in Burma in certain limestones and granite.

Once more does clay—the poor relation of these beautiful gems—show its connection with the family. It is in beds of clay and gravel that the best sapphires are found in Siam and Ceylon. In our own country in North Carolina and Montana these gems have been found also. But thus far we have not discovered any such great dazzling beauties as belonged to the emperors of old.

This is the story of the ruby and its sister sapphire. Now when you look into the windows of the jeweler, you will know just how some of his beautiful gems were formed, and about their strange history. Shall we study now about that bit of iron which gives the ruby its wonderful color?

### A METAL GIANT

In far away olden days people believed that great giants lived deep inside the earth. They believed that earthquakes and smoking volcanoes and spouting geysers were all made by these giants at their work. Many were the fanciful tales told about them. In time, however, we learned that it was only a fable that giant men live within the earth. Still, after all, there are giants there of a certain kind. Great metal giants they are, who do fully half the work of the world.

It will not be hard to guess which one of the metal giants is the largest and most important. It is iron. We have

all seen it used in countless kinds of machinery. And yet, only a few people have ever seen this giant himself in nature. Why is that? Because he always wears a disguise. In plain words, pure iron in nature is almost never found.

The reason for this is that iron so readily combines with other substances. You have all seen at least one disguise of this great giant. That is iron rust. It is with oxygen and water that the iron combines to make rust. A good disguise it is, for very different does this red rust look from pure iron. Pure iron is silver color.

In the most curious places this giant is found, and in the strangest forms. If you prick your finger you are sure to find it, for the red color of your blood is made by iron. The whole center of the earth is believed to be iron, too, pure iron. And not only our earth is made largely of iron, but there is iron in the "shooting stars" which flash across the sky. We are sure of this because when we pick up the hot shooting star stones, we find iron in them.

Usually we think of iron as having tremendous strength. "Strong as iron," we say. Yet it can be heated and drawn into fine wire, or pounded into thin sheets. In ancient days it was fashioned into swords and chariots and coats-of-mail. A blacksmith in olden times was a person of high honor.

### INDIAN WAR PAINT

Now about some other members of this giant's family. His relations-in-law we might call them, for they are the result of iron uniting with other substances. There are so many of them, we will have time to meet only a few. To begin with hematite, for instance. It is iron and oxygen. Usually it is in red, earthy masses or soft rocks. The Indians considered it very important. It was this rock which they powdered for their red war paint. Mixing it with grease they painted it on their faces until they looked hideous and terrifying.

But the Indians are not the only ones who have used hematite as paint. Much of the rouge which ladies put on their faces is made of this same red earth. The peace pipes of the Indians were carved from this rock in the old Indian days. So it has always been popular, this hematite, in both war and peace. Especially important it is to us today, for

much of the iron that we use is taken from hematite earth.

The red "lead" in your pencils is made of this powdered hematite which the Indians treasured. And the red paint on the outside of the pencils is manufactured from it too. Just scratch with some hematite on the edge of a piece of broken china. The rock will leave a rich red streak behind it. This red streak is one sign that it is real hematite. There is another thing which this hematite does that will interest you. It is this kind of iron which gives the ruby its rich red color, and the feldspar its delicate pink tint. A tiny bit of the hematite slips into them when they are forming into crystals and gives them their beautiful shades.

If you keep watch for these red rocks on your collecting trips, you are almost sure to find them. They are in nearly all parts of the United States. On some of them are Indian carvings. Sometimes the rock is partly crystallized into swelling bubbles and other interesting shapes. You will want some specimens of this hematite rock for your cabinet, and a bottle of its red powder—the Indian's war paint.

### KUNJERIN' STONE

Another form of iron has a most curious habit. It will pick up and hold fast any bits of iron or steel which it touches. That is because it is magnetic. Natural magnet, or lodestone, it is called. If you place a steel needle across a piece of lodestone, the needle will suddenly spring part way around on the specimen. Again and again it will do this.

That is, your needle will do this unless you happened to place it exactly toward the north magnetic pole of the earth. The needle acts like that because there are magnetic currents running through the earth. These currents have a north and south pole of their own, so they force the needle to point to those poles.

All sorts of interesting things you can make this lodestone do. If it is very magnetic it will hold up a whole row of tacks, their ends just touching one another. Or put some fine iron filings on a sheet of paper and hold the lodestone against the underside of the paper. As you move the stone, the filings will suddenly move and jump around as though alive.

Some people are very superstitious about this magnetic rock, or lodestone, as

it is often called. They believe that a piece of it carried in a pocket will draw many friends to its owner and keep those friends always loyal and true to them. A kunjerin' stone, they call it. Of course, that is only a fanciful belief with no truth in it. Lodestone attracts only metal, not people.

However, there is something which appears like magic that is probably true about this magnetic rock. Many prospectors and miners claim to have carried a piece of lodestone when searching for magnetic ore in the earth. They state that there is a distinct pull upon their specimen when a large mass of magnetic ore lies in the earth beneath where they pass.

It is well known that a large mass of lodestone in the earth will ruin the compasses and other instruments which may be brought near it. In the Yellowstone Park is a large mountain so filled with magnetic ore, that it cannot be mined. It ruins all the instruments of the engineers. Again and again lightning strikes this mountain far oftener than upon the mountains near it.

### CUBE IRON

This is a form of iron which makes an interesting and beautiful specimen for the cabinet. Its correct name is iron pyrite. But people call it cube iron because its bright brassy-yellow crystals are cube shape. The lines on the cubes are especially peculiar. Those on one face run exactly at right angles to those on the next face.

When this pyrite is in a small yellow mass, many times it has been mistaken for gold. Especially deceiving it is, when it mixes with the gold nuggets in a stream bed. So many people have believed it was real gold that it has been named "fool's gold." But your knife blade will tell you which it really is. You can cut real gold. But you cannot cut fool's gold. That is so many times harder, it will turn the edge of your knife blade. It easily cuts glass, which gold will not even scratch.

It is with sulphur that iron has united to make iron pyrite. So if you strike pyrite with a piece of steel, bright sparks will fly out. The stroke of the steel set the broken bits of sulphur on fire. Long ago, before matches were invented, men built fires with these sparks. Because

of the sulphur with the iron, pyrite is brass yellow instead of golden yellow like real gold. But often the pyrite is so shiny it is made into showy jewelry.

Where is this pyrite found? Everywhere. In all sorts of rocks and in the cracks and veins in them. Down in mines and among the pebbles of stream beds. The pretty cube crystals are plentiful, but there are other forms of iron pyrite too. Sometimes the crystal's shape themselves into round shiny balls. Often there are flecks of true gold in the pyrite masses. Sometimes it is quite full of it. Especially in the west much real gold is taken out of this fool's gold.

### MARCASITE SUNS

It is principally in the limestone rocks that you will find these little iron suns. Like the cube iron crystals these suns are made of iron and sulphur. But their shape is very different. The marcasite form of iron commonly crystallizes in masses, with long rays or fibers of the metal running from the center. When these masses are round and flat, they look like blazing little suns. They make wonderfully interesting specimens for the cabinet.

It is quite probable that some day your cabinet will have a surprise for you. Especially will the surprise come if you have not looked carefully at each specimen for some time. The reason will be that here and there a specimen will not look as it did when you put it in its place. Perhaps nothing is left of one of

them but a little heap of powder. Another may have grown tarnished and dull.

This will be because the weather has acted upon the minerals and changed them. Some are sensitive to the dampness in the air. Others change color if strong sunlight shines upon them. In others the color may have faded away. For one reason or another many changes come to them. Your marcasite sun may be one of these. Some day you may find it covered with a white powder. The chemicals in it and in the air will have acted upon one another.

Of what use is this cube iron and marcasite? It is of wonderful use to us. We could hardly do without it. The white clothes that you wear, and the linen that you use have been made with its help. The enamelware and tins in your cupboard, the colors of your clothes, the paraffin in your candles, and the celluloid buttons that you wear were all helped in their manufacture by this cube iron and marcasite.

But first the sulphur in the cube iron and marcasite had to be dissolved into sulphuric acid. Then it could do all these helpful things for us. It helps to make the terrible explosives used in war and elsewhere. And it is used in some of the fireworks we set off on celebration nights. All this and much more will this interesting form of iron and sulphur do for us, when we have changed it into acid. Your cabinet surely will want nice specimens of these pretty cubes and shiny suns.

There is no better place for the study of minerals than a good museum which has a mineral exhibit, as a knowledge of mineralogy cannot be obtained from books alone. It is only by studying a mineral in its various forms and becoming acquainted with it through frequent observations that one becomes able to readily identify minerals in the field or in unlabelled collections. If there is a museum within easy traveling distance of your home do not fail to visit it, to study the minerals in its collection, and to make notes and sketches of such specimens as may be of special interest to you. You will find such study of great value.

## CHIPS FROM THE QUARRY

*Fragments gathered up by the Editor*

It is gratifying indeed to know that mineral collectors really appreciate an interest taken by those of the younger generation in mineralogy. Miss Betty Browne of Pittsfield, Mass., whose interesting and inspiring account of "Mineral Collecting for Young People," which appeared in the last issue of this magazine, has tangible evidence of this, for not only has she received many letters of encouragement, but many attractive specimens of minerals were sent her by those who read her article. One subscriber and adviser, a dealer in minerals, was so grateful as to send her 57 varieties, a truly worthwhile addition to the collection in which she takes so much pride. We wish to express our own appreciation of this kindness extended to Miss Betty, and we are as much pleased over it as Miss Betty herself must be.

*Are Girl Scouts More Interested in Minerals Than Boy Scouts?* In going over our membership records we were more than surprised to find that we have five Girl Scout members of the Rocks and Minerals Association for every Boy Scout upon the membership roll. It is also an interesting fact that every Girl Scout who inquired about the Association became a member. What is the matter with the Boy Scouts? We supposed they would be more interested than the girls. We congratulate the Girl Scouts in outdistancing their brothers.

The week of February 5th was the Boy Scout Anniversary Week. We had occasion to visit three cities and in each looked up the exhibits by the Scouts. The displays were very attractive and interesting but we noted with considerable regret that in none of them was there an exhibition of minerals. We know that in some other localities minerals had a place in the Scout exhibitions. We believe that every Boy Scout troop should manifest sufficient interest in mineralogy to at least collect and know the rocks and minerals of its own section.

A young science teacher in one of the progressive high schools of New York State, has a unique method in teaching mineralogy to her class. A small cabinet is in one corner of the room in which are displayed mineral specimens obtained by purchase or donation. She encourages her students to search for specimens in the surrounding country and any that are brought her which are unusually good find a place of honor in this cabinet. These specimens have a complete label with this additional inscription: *Found and Presented to the School by ..... (Student's Name) ..... class of 19.....* This is not only encouraging to the pupil whose specimen is thus honored but arouses an ambition in others to be equally successful in finding something that will meet the approval of the teacher. Additional interest in mineralogy is also stimulated in the class.

We might say that ROCKS AND MINERALS is used to great advantage in the classroom of this school and the school itself is a member of the Rocks and Minerals Association.

The Peekskill Division of the Westchester County Park Commission of New York State, has started a collection of the local rocks and minerals found in the construction of its parkways. A large wooden frame enclosing a fiber cardboard, is nailed to the wall on one side of the office and small nails or tacks are driven in firmly at regular intervals from which the specimens found are suspended with cords or fine wire. Under each specimen is written the name of the mineral and where found. This display is meeting with very favorable comment by all visitors and especially by the engineers and officials of the Commission who drop in from time to time. This is a most encouraging venture and we hope the other offices of the Commission will adopt a similar plan.

ROCKS AND MINERALS has donated some foreign minerals to the Peekskill Division's display.

## GLOSSARY DEPARTMENT

A list of various mining, mineralogical, and geological terms, with explanation of each one. Free use has been made of various publications on mining, mineralogy, and geology, including bulletins of the U. S. Bureau of Mines and the U. S. Geological Survey. Webster's New International Dictionary has also been consulted.

*Alluvial tin*: Tin found in alluvial deposits, also known as *stream tin*.

*Alluvium*: A name given to deposits of earth, rocks, etc., by running water.

*Almandite*: A common variety of garnet chiefly red. When clear and transparent is used as a gem. Used as an abrasive.

*Alteration*: Any physical or chemical change in a rock or mineral that takes place in nature.

*Altered mineral*: Is a mineral in which a chemical or physical change has taken place. It is, therefore, an impure mineral. Practically every rock or mineral to be found on the surface of the earth is altered to some extent.

*Altered rock*: Same as altered mineral.

*Altitude*: A vertical distance or elevation above any given point. In geology and geography the altitude is figured from the sea-level as a base.

*Alum*: In chemistry, alum is any one of a group of salts which are hydrous double sulphates of aluminum, chromium, iron, or manganese, and one of the alkali metals. In mineralogy, alum is one of a group of minerals which are hydrous sulphates of aluminum, and potassium, sodium, or ammonium.

*Alumina*: Is the oxide of aluminum. Pure crystals of alumina are found in nature as gem crystals of corundum—Ruby and Sapphire.

*Aluminous*: Having the nature of alumina or clay.

*Aluminum*: One of the elements. A bluish-silver-white metal, malleable, ductile, sonorous, noted for its lightness and resistance to oxidation.

Symbol, Al; atomic weight, 27.1; specific gravity, 2.7. Also known as *Aluminium*.

*Aluminum bronze, or Aluminum gold*: An alloy of aluminum and copper resembling pale gold; used in cheap jewelry. As a powder, used in gilding.

*Aluminum minerals*: Alunite, Amblygonite, Andalusite, Bauxite, Corundum, Cryolite, Cyanite, Diaspore, Gibbsite, Sillimanite, Spinel, Topaz, Turquoise, Wavellite, and many silicates. The commercial ores of aluminum are Cryolite, a fluoride of sodium and aluminum, found only in Greenland (in commercial quantities); and Bauxite, a hydrous compound of alumina, ferric oxide, and silica, found in France (where it received its name after Baux—where it was first discovered) and in the United States.

*Aluminum ore*: Commercial ores of aluminum—Bauxite and Cryolite. Gibbsite could also be used as an ore if found in sufficient quantities.

*Aluminum silver*: A bright alloy of aluminum and silver that is used in instruments where lightness in weight is an object.

*Aluminum solder*: An alloy of gold, silver, and copper, with sometimes a little zinc. Used for soldering aluminum bars.

*Alum salts*: Natural salts from which alum can be made.

*Alum schist, shale, or slate*: Clayey rocks containing carbonaceous material and marcasite or pyrite that on altering yield common alum as an efflorescence.

*Alum stone*: An impure siliceous Alunite.

## THE SLUICE BOX

By A. RIFFLE

"Old Bill" is our only survivor of the old prospectors and I am the only one of the younger generation who takes any interest in minerals. Consequently when one of the Villagers or some Dry-lander wants a specimen identified he comes to "Old Bill" or me for the information. Once in a while some one of them tries to put over a joke on us. Not long ago the Village-cut-up told us that he had found a valuable gem mineral deposit and would bring us a sample for identification. A few days ago he saw "Old Bill" and me among a group of Villagers and he came up and handed me a specimen of a clear-red, glassy appearance. We ascertained afterwards that this meeting was framed up to get a laugh on us in a crowd. I noted a certain characteristic fracture immediately and simply handed the specimen over to "Old Bill" without further comment than saying: "What does it look like to you, Bill?" "Old Bill" hitched his glasses one notch lower on his nose, turned the specimen over in the palm of his hand, rolled his chew of "Ready Cut" over a couple of times and sprayed a fantastic sepia-colored design on the newly fallen snow, gave me a knowing look and said: "Well sir, that's as fine a specimen of 'Fordtailite' as I have ever seen." The cut-up bought the cigars.

As this is being written (late December) it looks like a long winter and a hard one ahead of us. It is a comforting reflection for those of us who are interested in minerals to know that the Editor is still on the job getting out ROCKS AND MINERALS in spite of handicaps and disappointments. His venture into the publishing field is certainly stimulating mineral collecting particularly among the younger generation and is in every way a distinct contribution to the enjoyment of our hobby. A good resolution for the New Year would be to resolve to hook a shoulder firmly under the wheel and give ROCKS AND MINERALS a good heave ahead for 1928.

Here is something that was suggested by a remark from the better half, and it is worth passing on. I was commenting one evening on the increasing investment in and value of my library and collection, and my wife remarked: "But what could I do with these things if something happened to you?" This started me thinking and this is the plan I evolved. I took an accurate inventory of my books, specimens, and appliances, together with notations as to condition, labelling, etc. I entered the cost and probable re-sale value of each item and wrote out explicit instructions as to my numbering system and also packing and shipping directions. This inventory I gave her to file away together with the names and addresses of three friends who are interested in minerals. This will insure that my wife can furnish an intelligent description of my possessions in this line and that the disposal of them will be in the hands of some one whom I implicitly trust to conserve her interests in the matter. This plan appeals to me as a good one to follow for anyone who has any considerable investment in something of which heirs have no practical knowledge. I expect to make this inventory up-to-date each year and urge you to do likewise.

An old adage claims that "It is better late than never." When you read this there will probably be signs of spring in the air but right now the snow is a foot deep on the level and only a surveyor could figure out how deep it is in the coulees. The Village thermometer says 40 degrees Fahr. below and still sinking but "Old Bill" and I are going to halt its downward course a bit with the warmth of our New Year wishes for all the supporters of ROCKS AND MINERALS.

We have tried to make this a column of both entertainment and information and barring the unforeseen we will be with you in 1928.



## PUBLICATIONS RECENTLY RECEIVED

*Little Sea-Folk*: By Ilsien Nathalie Gaylord—214 pages and many illustrations including one colored frontispiece. We are in receipt of a copy of "Little Sea-Folk" which explains to children some of the marvelous forms of life in the ocean. The book is written very much in the style of the author's articles on "The Beginner's Cabinet" which has been appearing in *ROCKS AND MINERALS*. It is profusely illustrated by Florence Liley Young with a colored frontispiece of sea-life. It is a most interesting book, not only for children but for older people as well, who are interested in forms of marine life and would like information about them which could be imparted in an entertaining and fascinating way.

The book is published by Little, Brown and Company, Boston, Mass.

*A Quantitative Mineralogical and Chemical Classification of Igneous Rocks*: By Edwin T. Hodge—200 pages, 7 figures and one large chart in pocket. This is a most interesting publication as it deals with new methods of classifying igneous rocks, permitting them to be arranged both mineralogically and chemically. It is an interesting presentation of Mr. Hodge's ideas, and we feel his methods will find great favor with all of us who are keenly interested in geology in general and rocks in particular.

Published by the University Press, University of Oregon, Eugene, Oreg., as Geological Series, Vol. 1, No. 2. Price: \$1.25.

*Crystalline Carnotite from Utah*: By Frank L. Hess of the U. S. Bureau of Mines and William F. Foshag, Assistant Curator of the U. S. National Museum. This most interesting pamphlet is a reprint No. 2707—Proceedings of the U. S. National Museum, Vol. 72, Art. 12, pp. 1-6, Washington, D. C. Though Carnotite is found in many places in the West visible crystals of the mineral have heretofore never been found. The pamphlet is interesting and valuable, therefore, as it describes a locality in Utah in which Carnotite is found in veinlets of a

golden-yellow color and beautifully crystallized in plates.

This pamphlet should prove of special interest to those who can, with more or less convenience, visit the locality as there is the prospect of securing some valuable specimens from the locality.

*Rossite and Metarossite: Two New Vanadates from Colorado*: By William F. Foshag, Assistant Curator, U. S. National Museum, and Frank L. Hess of the U. S. Bureau of Mines. Another valuable contribution to mineralogy is this pamphlet No. 2707—Proceedings of the U. S. National Museum, Vol. 72, Art. 11, pp. 1-12, with 2 figures. One of the interesting phases of mineralogy is the discovery of new minerals and naming same and in this report we have an excellent illustration how this is accomplished. It seems that Dr. Hess of the Bureau of Mines, in examining Carnotite deposits in Colorado noticed small veinlets of a pale yellow flaky mineral ranging from the thickness of cardboard to one-half inch and several feet long that cut the Sandstone in the deposit. Gypsum is so common in the sandstones that Dr. Hess at first supposed this was the mineral which formed the veinlets. Closer examination showed that the mineral had only one prominent cleavage and so could not be Gypsum. Some specimens, therefore, were collected and sent to the U. S. National Museum at Washington, D. C., for analysis. Later, more specimens were obtained from the owner of the deposit, Mr. M. E. O'Neill, and in this lot were some that had glassy centers and milky rims which were apparently the effect of dehydration. The analysis proved that it was a new mineral and to the clear, glassy mineral was given the name Rossite in honor of Dr. Clarence S. Ross, of the U. S. Geological Survey. To the lighter yellow and dehydrated, flaky mineral was given the name Metarossite as it was deemed advisable to distinguish between them in mineralogical nomenclature. Both minerals are hydrous calcium vanadates.



*Bulletin of the Massachusetts Audubon Society:* We are always pleased to call the attention of our readers to other branches of nature study, especially if this branch is endeavoring to preserve some feature of nature and to disseminate information among people in general and its members in particular. The Massachusetts Audubon Society is an organization banded together for the protection of birds and they need the full support and co-operation of all of us even though we may not be so keenly interested in ornithology. \$2 per year makes one a member of the Society which includes subscription to their monthly Bulletin. For further information address the Secretary, Massachusetts Audubon Society, 66 Newbury Street, Boston, Mass.

*The Military Engineer:* This is the official journal of the Society of American Military Engineers and is issued bi-monthly. The magazine is a most interesting publication. Its articles not only deal with Military and Engineering subjects but now and then popular descriptive articles of countries, travels, and

discoveries are featured. Many excellent illustrations appear in each issue.

The Society of American Military Engineers is organized in the interest of national defense; to advance knowledge of the science of military engineering; to promote efficiency in the military engineer service of the United States; to preserve the memory of services rendered by the engineering profession throughout the wars in which the United States has been engaged; to encourage, foster, and develop relations of helpful interest between the engineering profession in civil and in military life, and between the engineer and other arms of the military service.

All citizens of the United States who are interested in military engineering affairs and in preparedness for national defense are eligible to join the Society. Dues are \$4.50 per year which include *The Military Engineer* and other privileges of membership. For further information address the Secretary, Society of American Military Engineers, Mills Building, Washington, D. C.

The Editor of *ROCKS AND MINERALS* is a member of the Society.

## THE CABINET SPECIMEN

By AN OLD COLLECTOR

Why in collecting stamps are we so particular that the specimen shall be absolutely perfect—untorn, well-centered, and as little marred as possible by the inky daub of the cancellation office? And so well content with an imperfect mineral specimen, too small to be particularly attractive for its beauty, often with broken crystal faces, scratched or marred by improper handling and suitable only for purposes of analysis or of mere possession? I would rather have one excellent typical specimen of a mineral for which I had to pay \$5 than 25 small, unpretentious specimens, for which I paid 20c each. The cheap collector fills valuable space in a cabinet with cheap trash that is of interest to no one but himself, and which never can have either intrinsic or market value. Buy cheap specimens for study purposes if you will. When you get all you can out of them pass them along to some young collector for study or throw them away. For your cabinet procure the best specimens obtainable, regardless of price, and have something worth while.

## EDITORIAL

The illustration on the cover of this issue of *ROCKS AND MINERALS* is a picture of Copper Mountain, Sulzer, Alaska. The finest crystallized Epidote in America comes from this mountain. Other interesting minerals from this locality are: crystallized Uralites, crystallized Garnets, crystallized Limonites (pseudomorphs after Pyrite), and Quartz (Twin crystals on Epidote).

The snow-clad mountain in the center is Copper Mountain.

We are very much gratified to be able to announce to the readers of *ROCKS AND MINERALS* that the Rocks and Minerals Association has been duly organized and

officers elected for the ensuing year. For an account of the organization and an introduction of the new officers to the members, we refer our readers to the Bulletin Board of this issue.

In another part of the magazine will be found a brief statement regarding the purposes of the Association and a printed form for the proposal of new members. May we not ask each of our readers to try and secure one, if not more, members for the Association?

The dues are \$1 per year in United States and Possessions (\$1.25 foreign), payable in advance and this will include the year's subscription to *ROCKS AND MINERALS*.

## WITH OUR CONTRIBUTORS

Lieutenant-Commander P. J. Searles, whose very interesting article on the geology of Guam, which appears in this issue of *ROCKS AND MINERALS*, is a graduate of the U. S. Naval Academy and of Rensselaer Polytechnic Institute. He is connected with the Civil Engineer Corps of the U. S. Navy and his article is based upon his own observations in that far distant Island of Guam, where he was stationed for two years.

Lieutenant-Commander Searles is a Member of the American Physical Society; Fellow in Astronomy of American Association for Advancement of Science; Theta Xi Fraternity; Member Society of American Military Engineers; Society of Naval Engineers; Naval Institute; etc.

As Lieutenant-Commander Searles has lived in a number of out-of-the-way places such as Haiti, Corea, Guam, etc., we hope we may have other interesting articles from his pen in future issues of *ROCKS AND MINERALS*.

In connection with Lieutenant-Commander Searles' article we wish to acknowledge our indebtedness to *The Military Engineer*, the official publication of the Society of American Military Engineers, Washington, D. C., which has most kindly and courteously loaned us the cuts which are used with Lieutenant-Commander Searles' article. *The Military*

*Engineer* is a most interesting journal containing articles on Military and Engineering subjects as well as occasional articles descriptive of other countries. The magazine contains in each issue many excellent illustrations.

Lieutenant-Commander Searles had a very interesting descriptive article entitled: "Guam—An Outpost in the Pacific," in the November-December, 1927, issue of *The Military Engineer*.

The Editor of *ROCKS AND MINERALS* is a Member of the Society of American Military Engineers.

L. P. Bottley of Derby, England, who is a dealer in minerals and an expert mineralogist, has given us for this issue a very delightful article on Blue-John Fluorite. Mr. Bottley is known to some of the older readers of *ROCKS AND MINERALS* by his contributions and we take pleasure in commending him to the new readers of the magazine.

As a dealer, Mr. Bottley specializes in microscopic rock sections and he has a most wonderful stock of these interesting sections. Mr. Bottley is a regular advertiser in *ROCKS AND MINERALS* and we take pleasure in recommending him to our readers who may desire to procure some of these sections.

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